

1. International Symposium on Sustainable Development, June 9-10 2009, Sarajevo

## **Analysing Business Competition by Using AHP Weighted TOPSIS Method: An Example of Turkish Domestic Aviation Industry**

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**Abstract:** The article uses AHP weighted TOPSIS multi-methodological approach in the Turkish domestic aviation industry. It starts by describing exceedingly complex nature of competition in the sector. Then, it deals with the constituent parts of the research methodology and the eclectic approach itself. The implementation of AHP weighted TOPSIS method reveals the ranking of major air carriers in light of key success variables in the sector.

**Keywords:** strategy, AHP weighted TOPSIS, multi-methodology, TOPSIS.

### **1. Introduction**

The purpose of this article is to apply AHP weighted TOPSIS approach to the Turkish domestic aviation sector in order to rank air carriers according to their relative closeness coefficient on the basis of criteria that are most critical to success and prosperity in the industry. This analysis provides useful information for airline companies about evaluating their objectives and strategies. To reach this end, in the first section the article initially describes the nature of rising competition in the Turkish domestic aviation industry that became a menace to the survival of firms during the period 2003-2007 as well as provides brief information about the chief characteristics of major domestic air carriers in the sector. The next section, called background information about research methodology, explains AHP weighted TOPSIS method, namely analytic hierarchy process (AHP) method, and the traditional TOPSIS method, and then proposed AHP weighted TOPSIS method. We assume that this multi-methodological AHP weighted TOPSIS approach with its wide-ranging applications meet the requirements of survival volatile environments like aviation industry. Then the following section, called the application of the AHP weighted TOPSIS method, undertakes a real industry case from a comparative perspective that provides full and invaluable data for airline companies in the sector so that they should review their goals, strategies, plans, and programmes. Conclusion is provided in the final section.

### **2. The Nature of Turkish Domestic Aviation Industry**

Although the Turkish aviation sector has been negatively affected by the political and financial crises, it has continued its progress in the long term with the growth of economy, liberalisation, globalisation, developing international trade, lowering prices, and expanding service net. This sector's climax was the terrorist attack in 9/11 2001 in the U.S. The aviation sector was globally harmed due to this attack that gave rise to the bankruptcy of some prominent airline companies. While the aviation sector was trying to recover itself, it was damaged again by Gulf War and SARS illness in the Far East Asia in 2003. But, Iraqi War was shorter than expected and SARS was taken under control, so aviation sector got into growing trend in 2004.

The high performance of the Turkish economy in recent years, the rising numbers of tourists coming to Turkey, the lower prices of the private airline companies after the tax cut on flight prices in 2004 accelerated the

Turkish aviation transportation to the sector. Though the domestic passenger number was 8, 7 million in 2002, it rose to nearly 20 million in 2005. This number was 38 percent more than the number in 2004.

By 2006, the Turkish aviation sector had 204 passenger planes, 24 cargo planes and capacity of 38 thousand passengers. Although the Turkish Airlines had domestic flights from two airports to 25 scheduled domestic points in 2003, the flights today are from seven airports by five airline companies to 38 points. If we bear in mind the Turkey's advantageous geographical condition, interregional trade development, and the improvement efforts in tourism, the Turkish aviation sector which has a current growing trend is expected to continue its expansion process.

Turkey due to its geographical location acts like a point of passing between Europe, Middle East, and Asia. Improvements in recent years as well as Turkey's liberal policies and bilateral agreements have turned this hectic geographical area to a special centre for passenger and cargo transportation.

However there are still 70 idle airports nationwide that can be opened to air traffic in Turkey. In particular, in the East part of Turkey the number of unused airports is high due to the topographic structure of this region. In a short time, the increasing need for air transportation would bring these airports in use and provide important benefits for Turkey.

In terms of competition in the Turkish Domestic Air Transportation after the privatisation of Turkish Airlines in 2003 the number of passengers in Domestic Air Transportation was noticeably increased. This led to new air carriers enter the aviation sector and the competition became severe. The slogan of "Every Turk will try plane at least once" became popular in the Domestic Air Transportation. In relation with the incentive policy to make the domestic flights attractive and to bring activity to regional airports there has been a reduction in DHMI (Government Airport Service) tariffs, and a cut in private communication tax. Furthermore, the Ministry of Transport abolished the education contribution pay in 2003 and gave authorisation of domestic flights to the private airline companies. With this practice a couple of new carriers such as Fly Air, Onur Air, Pegasus Airlines, and Atlas Jet entered the market. As a consequence, a sudden change and a cutthroat competition developed in the sector. This increased the number of domestic passengers (Table 1). Private firms increased domestic flights by taking their licenses. Onur Air, Pegasus Airlines, and Atlas Jet became initial firms that took their licenses.

**Table 1: Number of Domestic Passenger Carried in 2006**

<b>Rank</b>	<b>Companies</b>	<b>Number of Passenger</b>
1	Turkish Airlines	8.857.000
2	Onur Air	4.400.267
3	Atlas Jet	2.982.712
4	Pegasus	1.818.989

### 3. Background Information about Research Methodology

This section briefly describes the analytic hierarchy process (AHP) technique, and the TOPSIS method, and proposed AHP weighted TOPSIS method.

#### 3.1. The Analytic Hierarchy Process (AHP) Methodology

The analytic hierarchy process (AHP) methodology, which was developed by Saaty (1980), is a powerful tool in solving complex decision problems. The AHP helps the analysts to organize the critical aspects of a problem into a hierarchical structure similar to a family tree. By reducing complex decisions to a series of simple comparisons and rankings, then synthesizing the results, the AHP not only helps the analysts to arrive at the best decision, but also provides a clear rationale for the choices made (Chin et al., 1999). In AHP approach, the decision-maker is required to provide his preferences by pairwise comparisons, with respect to the weights and scores (Chu and Lin, 2003).

#### 3.2. The TOPSIS Method

TOPSIS method is a technique for order preference by similarity to ideal solution (Hwang and Yoon, 1981). The ideal solution (also called positive ideal solution) is a solution that maximizes the benefit criteria/attributes and minimizes the cost criteria/attributes, whereas the negative ideal solution (also called anti-ideal solution) maximizes the cost criteria/attributes and minimizes the benefit criteria/attributes. The so-called benefit criteria/attributes are those for maximization, while the cost criteria/attributes are those for minimization (Bellman and Zadeh, 1970). The best alternative is the one, which is closest to the ideal solution and farthest from the negative ideal solution.

### 3.3. The Proposed AHP Weighted TOPSIS Method

The basic steps of proposed AHP weighted TOPSIS method can be described as follows:

**Step 1.** In the first step, a panel of decision makers (DMs) who are knowledgeable about airline selection and evaluation process is established. In a group that has K decision-makers (i.e. D1, D2, ..., Dk) are responsible for developing the hierarchical structure of the airline evaluation and selection. Then, using AHP technique, the normalized weights for each evaluation and selection criterion are determined.

**Step 2.** In the second step, DMs evaluate the performance of each airline company with respect to each criterion to obtain a decision matrix.

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}$$

**Step 3.** After forming the decision matrix, normalized decision matrix is obtained as:

$$R = \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1n} \\ r_{21} & r_{22} & \dots & r_{2n} \\ \dots & \dots & \dots & \dots \\ r_{m1} & r_{m2} & \dots & r_{mn} \end{bmatrix}$$

**Step 4.** The weighted normalized decision matrix is computed by multiplying the importance weight of evaluation criteria and the values in the normalized decision matrix.

**Step 5.** Then positive and negative ideal solutions are determined.

**Step 6.** Then the distance of each alternative from positive and negative ideal solutions are calculated.

**Step 7.** Then the closeness coefficient CC is determined.

### 4. The Application of AHP Weighted TOPSIS Method

The application of the proposed algorithm is explained in the following steps.

**Step 1.** In the first stage, a panel of ten DMs from various departments including purchasing, quality, and production and planning who are involved in Strategy process was formed. Based on semi-structured interviews with DMs, a list of nine Strategy Process criteria was generated. These criteria are related to various aspect of strategy ranging from Advertising Product Quality, Price Competitiveness, Customer Loyalty, Market Share, Customer Service, E-commerce, Management Experience, and Branding. The DMs were then asked to specify the relative importance of airline selection criteria using pairwise comparison scale. Then normalized weights for each criterion were obtained. These values are shown in Table 2.

**Table 2:** Normalized Weights for each Evaluation Criteria

	<b>standart</b>
Advertising	0.0417
Product Quality	0.2584
Price Competitiveness	0.1499
Customer Loyalty	0.1555
Market Share	0.0551
Customer Service	0.1396
E-commerce	0.0249
Management Experience	0.0981
Branding	0.0767
<b>Total</b>	<b>1.0000</b>

**Step 2:** In this step, we measure the performance of firms with respect to each strategy criterion. Table 3 shows the decision matrix of selection criteria.

**Table 3:** Decision Matrix

	Advertising	Product Quality	Price Competitiveness	Customer Loyalty	Market Share	Customer Service	E-commerce	Management Experience	Branding
THY	5	5	3	4	5	5	5	5	5
Onur Air	2	2	4	2	3	1	3	2	1
Pegasus	3	3	5	3	4	3	4	4	3
Atlasjet	3	3	4	2	3	2	3	2	1

**Step 3:** In this stage, normalized decision matrix is obtained depending on whether the objective of selection criterion is that of minimization or maximization. Table 4 shows the normalized decision matrix.

**Table 4:** Normalized Decision Matrix

	<i>max</i>	<i>max</i>	<i>max</i>	<i>max</i>	<i>max</i>	<i>max</i>	<i>max</i>	<i>max</i>	<i>max</i>
	Advertising	Product Quality	Price Competitiveness	Customer Loyalty	Market Share	Customer Service	E-commerce	Management Experience	Branding
Turkish Airlines	0.7293	0.7293	0.3693	0.6963	0.6509	0.8006	0.6509	0.7143	0.8333
Onur Air	0.2917	0.2917	0.4924	0.3482	0.3906	0.1601	0.3906	0.2857	0.1667
Pegasus	0.4376	0.4376	0.6155	0.5222	0.5208	0.4804	0.5208	0.5714	0.5000
Atlasjet	0.4376	0.4376	0.4924	0.3482	0.3906	0.3203	0.3906	0.2857	0.1667

**Step 4:** Then weighted normalized decision matrix is calculated. The weighted normalized decision matrix for each selection criterion is shown in Table 5.

**Table 5:** Weighted Normalized Decision Matrix

	Advertising	Product Quality	Price Competitiveness	Customer Loyalty	Market Share	Customer Service	E-commerce	Management Experience	Branding
THY	0.0304	0.1885	0.0554	0.1083	0.0359	0.1117	0.0162	0.0701	0.0639
Onur Air	0.0122	0.0754	0.0738	0.0541	0.0215	0.0223	0.0097	0.0280	0.0128
Pegasus	0.0183	0.1131	0.0923	0.0812	0.0287	0.0670	0.0130	0.0561	0.0384
Atlasjet	0.0183	0.1131	0.0738	0.0541	0.0215	0.0447	0.0097	0.0280	0.0128

**Step 5 and Step 6:** The positive and negative ideal solutions are determined. Table 6 and 7 show the ideal solutions.

**Table 6:** Positive Ideal Solution and its Distance for Each Alternative

	Advertising	Product Quality	Price Competitiveness	Customer Loyalty	Market Share	Customer Service	E-commerce	Management Experience	Branding
THY	0.0000	0.0000	-0.0369	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Onur Air	-0.0183	-0.1131	-0.0185	-0.0541	-0.0144	-0.0894	-0.0065	-0.0421	-0.0511
Pegasus	-0.0122	-0.0754	0.0000	-0.0271	-0.0072	-0.0447	-0.0032	-0.0140	-0.0256
Atlasjet	-0.0122	-0.0754	-0.0185	-0.0541	-0.0144	-0.0670	-0.0065	-0.0421	-0.0511

**Step 7:** The closeness coefficient CC is determined. As initial average weights were used in the TOPSIS calculations, the values of CC in Table 8 are considered as crisp TOPSIS results.

**Table 7:** Negative Ideal Solution and its Distance for Each Alternative

	Advertising	Product Quality	Price Competitiveness	Customer Loyalty	Market Share	Customer Service	E-commerce	Management Experience	Branding
THY	0.0183	0.1131	0.0000	0.0541	0.0144	0.0894	0.0065	0.0421	0.0511
Onur Air	0.0000	0.0000	0.0185	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pegasus	0.0061	0.0377	0.0369	0.0271	0.0072	0.0447	0.0032	0.0280	0.0256
Atlasjet	0.0061	0.0377	0.0185	0.0000	0.0000	0.0223	0.0000	0.0000	0.0000

**Table 8:** Computations of AHP Weighted TOPSIS Method (CC)

<b>Firm</b>	<b>CC</b>
THY	0.8211
Onur Air	0.0977
Pegasus	0.4631
Atlasjet	0.2620

## 5. Conclusion

In this study, the AHP weighted TOPSIS methodology has been employed as an alternative to the conventional TOPSIS approach. When AHP weighted TOPSIS approach has been implemented, the Turkish Airlines has been identified as the most suitable company, Pegasus the runner-up, Atlasjet the third, and Onur Air the fourth (Table 8). This research finding indicated that the Turkish Airlines preserved its dominant role even after its privatization and new entrants in the domestic airline industry. It is worthy of noting that Pegasus though newly founded air carrier could intensify the competition in the sector and become a serious rival for the Turkish Airlines in the coming years.

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